VOL. XIII. SEPTEMBER AND OCTOBER, 1886. NOS. 9 AND 10.

THE

Journal

OF

Nervous and Mental Disease.

Original Articles.

PRESIDENTIAL ADDRESS.

INTRODUCTORY REMARKS ON THE WORK OF THE AMERICAN NEUROLOGICAL ASSOCIATION.

ARRESTED AND ABERRANT DEVELOPMENT OF FISSURES AND GYRES IN THE BRAINS OF PARANOIACS, CRIMINALS, IDIOTS, AND NEGROES. DESCRIPTION OF A CHINESE BRAIN.*

By CHARLES K. MILLS, M.D.,

PRESIDENT OF THE AMERICAN NEUROLOGICAL ASSOCIATION; VICE-PRESIDENT OF THE PHILADELPHIA NEUROLOGICAL SOCIETY; PROFESSOR OF DISEASES OF THE MIND AND NERVOUS SYSTEM IN THE PHILADELPHIA POLYCLINIC AND COLLEGE FOR GRADUATES IN MEDICINE, ETC.

PART I.—Published work of the members of the American Neurological Association—Remarks on Membership and on the By-Laws—Congress of American Physicians and Surgeons—Objects, Duties, and Dangers of Special Associations—Personal and Impersonal Criticism.

PART II.—Arrested and Aberrant Development of Fissures and Gyres—Importance of the Study of the Comparative Anatomy of the Brain—Some Points from the Brains of the Primates—Simian and Human Brain Compared—Indications of a Low or Aberrant Type of Human Brain—Description of the Brains of Burk, Taylor, Beach, of a Feeble-Minded Youth, and of a Negro — Indications of Atypical Asymmetry — The Brain of Guiteau—The Question of a Criminal Type of Brain and the Anatomical Basis of Crime.

PART III.—Preliminary Study of a Chinese Brain, by A. J. Parker, M.D., and Chas. K. Mills, M.D.

I.

ALTHOUGH prevented from attending the last meeting of the Association, you did me the honor to unanimously elect me President for the year which begins

* Presidential address, delivered at the meeting of the American Neurological Association held at Long Branch June 21, 22, and 23, 1886.

to-day; and for this honor I cordially thank you, although I feel poorly fitted to occupy the chair which has been filled by such distinguished predecessors.

The Association may well congratulate itself upon the large amount of published work which has been done by its members since the last annual meeting. In Pepper's "System of Practical Medicine by American Authors," of the 1326 pages of the fifth volume, which now constitutes the greatest general treatise on nervous diseases which has ever been written, no less than 843 have been contributed by members of this Association. American medical periodicals, both neurological and general, have also amply exhibited in their pages the work of members of this Association.

I am glad to note a tendency to the filling of our ranks with new members. Much in this direction can be done by individual effort on the part of those who have the interests of the Association at heart. Our membership ought to be at least doubled by the addition of acceptable physicians from all sections of the country; for the American Neurological Association should be in fact, as well as in name, the great national representative body of those members of the American profession who are interested, either practically or theoretically, in neurology and psychiatry, and the branches of science which are especially correlated and auxiliary to these subjects. It might well include in its membership some anatomists, zoölogists, histologists, and psychologists, etc., who are particularly concerned with a study of the nervous system, either in man or the lower animals, even although not physicians. We have not in this country, as in Great Britain, and in several nations of Continental Europe, a great Medico-Psychological Association. In place of it we have only the Association of Medical Superintendents of the American Institutions for the Insane; and the National Association for the Protection of the Insane and the Prevention of Insanity, which is not confined to the medical profession in membership, and which has been a society rather of a humanitarian character than one which has either called forth or sustained scien-

tific enterprise in neurological fields. These associations may have distinctive and useful spheres of their own; they may serve a good purpose in some directions; but such of their members as are professionally and scientifically worthy of the honor, should be admitted to this Association; and so should those medical jurists who take an active part in special investigations into the mind and nervous system: although I would not, for a moment, advocate the cheapening of membership, or the enlargement of the opportunities for obtaining it beyond reasonable limits.

The adoption of the amendment to Article IV. of the By-Laws, by which it has become the rule that all business, not of a scientific nature, shall be transacted in executive session, will do much towards making our meetings more interesting. It will insure to those who are on the programme for papers or discussion at certain times, that their work shall not be excluded or postponed by tedious discussion of unexpected matters of policy or business. The amendment to Article VI. of the Constitution, adopted at the meeting held June 21st of the present year, by which that Article is now made to read, that "the annual meeting of the Association shall be held on any two or three days in the month of July in each year, as may be chosen by the Council, which shall also designate a place of meeting," will, also, I believe, have a favorable influence upon the welfare of the Association. The holding of meetings in different sections of the country, a plan which is inaugurated with the present session, will tend to make our organization more thoroughly national.

I wish now to refer briefly to a matter which I have deeply at heart. It is well known to a majority of the members of this Association that a project is on foot and well under way for the organization of a Congress of American Physicians and Surgeons. This measure originated in the American Surgical Association, with the distinguished Southern surgeon, Dr. C. H. Mastin, of Mobile, Alabama. A memorial and accompanying resolutions regarding it have been transmitted to me by Dr. Mastin, and also by Dr. J. Ewing Mears, Secretary of the Committee of the

American Surgical Association. The memorial and resolutions will come before you for formal action at the executive session to-day. The details of the project are doubtless familiar to most of you.

It is proposed to unite the following-named associations into a Congress to be called "A Congress of American Physicians and Surgeons": the American Surgical Association, the American Ophthalmological Association, the American Otological Association, the American Neurological Association, the American Laryngological Association, the American Gynæcological Association, the American Dermatological Association, the American Climatological Association, and the Association of American Physicians.

The plan of organization proposed embodies the following points: each society is to select its own officers, hold its own sessions apart from the others at the time and place of meeting of the Congress, publish its own transactions, and do all other acts which by virtue of its constitution and by-laws it has the inherent right to do, thus preserving its own autonomy; the Congress to be composed of these special societies when in session, and its meetings to be held in the city of Washington; the constitution and by-laws of the Congress to be formed by a committee of the like number from each special society; the opening session of each annual meeting of the Congress to be devoted to such general business as might pertain to the interests of the association as a whole; the Congress to be presided over by a president, elected annually, who must deliver an opening address on the first day of the session; the president to be chosen by a nominating committee of one from each special society; the presidents of the special societies to be *ex-officio* vice-presidents of the Congress; membership in the Congress to be acquired only by virtue of fellowship in one or other of the special organizations; the other officers to be determined upon by the convention in session.

Personally I am heartily in favor of this movement, and I trust that the American Neurological Association will unanimously indorse it, and appoint a committee of confer-

ence. Of the associations which it is proposed to unite to form the Congress, the American Surgical, the American Climatological, and the American Laryngological Association, and the Association of American Physicians, have already indorsed the project and appointed committees.

Some difficulties may arise in connection with the initiation of the Congress; some differences of opinion there may be as to the plan of organization and methods of holding the meetings; but with committees composed of men who have both the interests of the special organizations which they represent, and the general welfare of the entire project at heart, I have no doubt that such difficulties can be readily overcome and such differences promptly arranged. One danger apprehended by some is that the Congress may drift, insensibly, perhaps, into the arena of medical politics; but, if wisdom prevails during the development and crystallization of the plan of organization, the rocks and shoals so much dreaded can, with comparative ease, be avoided.

The plan submitted in the memorial of Dr. Mastin is, on the whole, a good one, but might, it seems to me, be improved in some respects. It would, I believe, be better for the meetings of the Congress to be biennial, thus allowing the associations as special organizations to have entirely separate and independent meetings on alternate years. Among other advantages, this would allow the separate associations to meet every two years in different sections of the country —at the seashore, in the mountains, or in some great city— according to the wishes of a majority of the members. The meetings of the Congress as such, however, should be held at a fixed place; it should have a local habitation as well as a name, and should not allow itself to degenerate into a wandering, social body. Some differences may arise as the most suitable place to hold the meeting of the Congress. Personal preference should yield to the will of the majority of those who confer. Washington being the national capital, having within its limits the great Congressional Library and Army Medical Museum, being geographically best situated to the different medical sections of the country, should receive the preference, but this is a matter which can be decided

satisfactorily by a wise committee of conference. It would be well if some plan could be adopted by which the presidency of the Congress should be held successively by a member of each different organization entering into its composition. No one should be reëlected to the position. During the days of the sessions of the Congress, both general and special meetings could be held; for example, a general meeting of the Congress with a carefully arranged programme in the mornings of each day, and special independent sessions of each constituent organization in the afternoon. This plan would permit the coming together for mutual advantage and criticism of individuals representing all branches of the science of medicine, and would allow, at the same time, the special organizations to do much of their own work in their own way after the manner of the sections of the American and the British Medical Associations. The proceedings both of the general and of the special meetings should be published in one volume. The authors of addresses, papers, and all forms of scientific contributions, should, however, be allowed to publish their production, at least in abstract, in medical periodicals, and not wait for the slow process of publication of an annual volume.

In concluding these introductory remarks, a few words with reference to the object, duties, methods of conduct in a society of this kind may not be out of place. I cannot do better than repeat the words of one of the original members of this Society, Dr. S. Weir Mitchell. In discussing, before the Philadelphia Neurological Society, the object and duties of special societies, he said very truly that if they have any real reason for existence, it is in the fact that they bring together in groups men having common interests, so that these men stimulate one another by example and criticism, and by the sympathy arising out of unity of pursuits; that it is never well to be absolutely isolated in our pursuits; that all men do more and better work amidst the competition of other workers; that some men can do no work unstirred by the ferment of companionship in like efforts. "In these subtle agencies lies the value of associations like ours—in the examples they offer, the dis-

cipline they teach, the criticism they afford, the sympathy they evolve. The advantage of small societies is that they secure definiteness of aim, and that we hear only what interests all who are present." The same distinguished physician points out that the danger of such bodies is narrowness.

An association like the American Neurological Association, any scientific body that deserves the name, should not degenerate into a mutual admiration society; but, on the other hand, it should not become an arena for the settlement of either past or prospective personal disputes and difficulties. Papers read, and subjects introduced for discussion, should be subjected to careful, severe, and, if called for, even hostile criticism; but such criticism should always be exercised and administered from the scientific and impersonal standpoint.

II.

The President of this Association owes a duty to its members from the scientific side. He should contribute, not only as a member of the Association but also in reciprocation of the honor conferred upon him, some new facts to the proceedings of the meeting at whose sessions he presides. It is my purpose, in addition to the remarks which have just been made with reference to some of the special interests of the Society, to present for your consideration a paper upon the study of arrested and aberrant fissures and gyres, which will be illustrated by descriptions and references to the brains of paranoiacs, criminals, idiots, negroes, and apes.

My study will be confined to the topography of the cerebral surface. This is but a limited portion of the great field of cerebral anatomy. The practical importance of such a study to neurologists, and more particularly to general practitioners, may to some, at first sight, appear to be slight. Looked at closely, however, such will be seen not to be the case. Much of the confusion and many of the controversies in connection with the great subject of cerebral localization, which has to so large an extent occu-

pied the medical profession, particularly neurologists, neuro-physiologists, and neuro-pathologists, during recent years, have arisen from an imperfect acquaintanceship with cerebral morphology.

My object being to direct attention to certain conditions of arrested and aberrant development in the specimens to be exhibited—to demonstrate abnormalities and peculiarities in the formation of gyres, fissures, and lobes,—a few facts of comparative anatomy and of human cerebral anatomy, a comprehension of which is necessary to an understanding of the questions discussed, will be first briefly considered. The specimens present in striking degree such characteristics as atypical asymmetry of the hemispheres in bulk and in fissural and gyral arrangement, ape-like similarities and affinities, and a persistence of embryonic and fœtal peculiarities.

The physician should, by a study of the brains of primates, of fœtal brains, and of brains supposed to be normal, obtain a good working knowledge of the average arrangement of the hills and valleys of the cerebral surface. Observations have not been sufficient to enable us to say with great positiveness what we would expect to find in every brain which is alleged to be normal, but scattered contributions on the subject of cerebral morphology permit us to arrive at some approximate conclusions. In the literature of the subject a few names are prominent, such as, for instance, in Germany and Austria, Bischoff, Virchow, Ecker, Meynert, and Benedikt; in France, Gratiolet and Broca; in Italy, Lombroso; in Great Britain, Huxley, Turner, and Rolleston; and in America, Parker, Wilder, Osler, and Spitzka. The treatise of Gratiolet, "On the Convolutions of Man and the Primates," is among the greatest of the contributions to the study of the cerebral surface.

While we have not as yet what might be termed an average standard adult brain, what can be hoped for is that the observer, even the practitioner of medicine of ordinary attainments in cerebral anatomy, shall have a fair idea of brains of different types or degrees of inferiority or superi-

ority of development. Some authorities deny that the fissures and gyres of the human brain can be elucidated by a study of the lower animals, and perhaps in some respects it would be best always to describe and figure what is found without reference to any views as to affinities with or differences from other animals. Even so high an authority as Meynert, however, takes as his starting-point the brain of a monkey. Bischoff holds that the monkey brain is not a miniature model of the human brain, but represents arrested stages in the development of the latter. Equally important is the study of fœtal brains in different stages, and of the post-natal brain at different ages.

In the higher forms of quadrupeds, fissures and gyres are arranged in certain types—oblique, longitudinal, and transverse; and a few well-marked, so-called, primary fissures are common to all types. In the quadrumana, new features appear, among the most important of which are primary fissures similarly disposed, and the gradual development of secondary and tertiary fissures, dividing the surface of the brain into lobes and gyres according to a new but constant pattern, like that of the human brain. The principal of these in the primates are the Sylvian, the central, the external perpendicular, the supertemporal, the parietal, the occipital, the hippocampal, the calcarine, and the supercallosal.[1]

A study of the size, development, branchings, and surroundings of these great fissures in man and in the primates gives points of departure in the consideration of the question of highness and lowness of type—that is, of relative superiority or inferiority.

---

[1] In describing fissures and gyres I shall in the main use the nomenclature of Prof. Burt G. Wilder of Cornell University.

Prof. Wilder, (JOUR. OF NERV. AND MENT. DISEASES, vol. xii., No. 3, July, 1885) has suggested:

1. That all the indentations of the cerebrum be called fissures (abbreviation, F.), and that this word be restricted thereto.

2. That, excepting a few parts (*insula*, *cuneus*, *præcuneus*, *paracentral lobule*, *uncus*, *subiculum*, etc.) which have received special names, all the inter-fissural elevations be called gyres, Latin gyri (abbreviation, G.), and that this word be restricted thereto.

3. That, so far as possible, mononymic names for the fissures and gyres be selected from among those which are in use, or formed therefrom by substituting prefixes for words indicating relative position.

The most important suggestions as to naming fissures and gyres are shown in the following table:

One of the most important fissures in the ape is the external perpendicular; in the man-like apes it is particularly well-marked, a deep gash separating the parietal from the occipital lobe, chiefly on the lateral aspect of the hemisphere, but reaching well up to the median edge, with a continuation on the inner aspect, known as the internal perpendicular fissure. In its depths are certain gyres, con-

	Wilder.	
Name	*Abbreviation*	*Synonym*
FISSURES, MAINLY OR PARTLY MESAL.		
Callosal,	CL,	Callosal.
Supercallosal,	SPCL,	Calloso-marginal.
Occipital,	OC,	Parieto-occipital.
Calcarine,	CLC,	Calcarine.
Collateral,	CLT,	Collateral.
Hippocampal,	HMP,	Hippocampal.
GYRES, MAINLY OR PARTLY MESAL.		
Callosal,		Gyrus fornicatus.
Paracentral,		Paracentral lobule.
Precuneus,		Precuneus.
Cuneus,		Cuneus.
Subcalcarine,		Lingual lobule.
Subcollateral,		Fusiform lobule.
Hippocampal,		Hippocampal.
Uncus,		Gyrus uncinatus.
Subiculum,		Subiculum.
FISSURES, MAINLY OR PARTLY LATERAL.		
Sylvian,	S,	Posterior branch of S.
Presylvian,	PRS,	Ascending branch of S.
Subsylvian,	SBS,	Anterior branch of S.
Basisylvian,	BS,	Basal portion of S.
Olfactory,	OLF,	Olfactory.
Orbital,	ORB,	Orbital or Triradiate.
Central,	C,	Fissure of Rolando.
Precentral,	PRC,	Precentral.
Superfrontal,	SPFR,	First frontal.
Subfrontal,	SBFR,	Second frontal.
Postcentral,	PC,	Retrocentral.
Parietal,	PTL,	Interparietal.
Supertemporal,	SPTMP,	Parallel or first temporal.
Subtemporal,	SBTMP,	Second temporal.
Exoccipital,	EOC,	Wernicke's.
GYRES, MAINLY OR PARTLY LATERAL.		
Insula,		Island of Reil.
Subfrontal,		Third frontal.
Superfrontal,		First frontal.
Precentral,		Precentral.
Postcentral,		Postcentral.
Parietal,		Superior parietal lobule.
Marginal,		Inferior parietal.
Angular,		Angular.
Supertemporal,		First temporal.
Subtemporal,		Second temporal.

volutional masses which tend to fill up the bridge over the chasm as brains advance in grade. In man usually the chasm becomes nearly or quite filled with brain substance.

Rolleston,[1] referring to this fissure, says that "in one part of the brain, where two of the five great masses into which its convoluted surfaces may be mapped out abut

---

Besides these names which correspond to fissures and gyres described by writers and anatomists generally, Wilder has introduced several new terms descriptive of what he regards as new fissural integers and gyres. With some of his suggestions I accord, with others I do not. The chief of these new suggestions are as follows: *Paracentral fissure*, PARC, the terminal portion of the supercallosal fissure; *Precuneal fissure*, PRCN, a fissure crossing the precuneus; *Paroccipital fissure*, PAROC, the posterior portion of the parietal fissure with the transverse occipital of Ecker; *Postcalcarine fissure*, PCLC, a fissure in the extremity of the occipital lobe; *Amygdaline fissure*, AMYG, a fissure at the tip of the temporal lobe near its median border; *Postcalarine gyre*, a gyre in the occipital lobe posterior to the calcarine fissure; *Medifrontal fissure*, MFR, a somewhat common fissure of the frontal lobe between the superfrontal and subfrontal fissures; *Meditemporal fissure*, MTMP, a fissure between the supertemporal and subtemporal; *Paroccipital gyre*, the first occipital gyre of Ecker, or the superior external *pli de passage* of Gratiolet; *Mediocciptal gyre*, the second occipital gyre of Ecker; *Suboccipital gyre*, the third occipital of Ecker.

In some cases in the text the names of Gratiolet, or others, have been used in describing parts, as, for instance, the *plis de passage*, which are not recognized or named by Wilder.

The following are the most important publications of Prof. Wilder on the subject of encephalic nomenclature:

A Partial Revision of Anatomical Nomenclature, with Especial Reference to that of the Brain. *Science*, ii., No. 38, pp. 122–126; No. 39, pp. 133, 138; March 19 and 26, 1881.

On Encephalic Nomenclature. Am. Neurol. Assoc. 1884, JOUR. NERV. AND MENTAL DISEASE, July, 1884, 18, 50; abstract.

Methods of Studying the Brain. The "Cartwright Lectures" for 1884. *N. Y. Med. Jour.*, February 9, 16, 23; March 1; April 6, 26; May 10; June 14; August 2.

On Some Points in Anatomical Nomenclature. Am. Assoc. Proc., 1884; abstract.

Encephalic Nomenclature. 1. Cœlian Terminology; the Names of the Cavities of the Brain and Myelon. *N. Y. Med. Jour.*, xli., pp. 325–328, 354–357, March 21 and 28, 1885; 8 fig.

Paronymy *versus* Heteronymy as Neuronymic Principles. Presidential address at eleventh annual meeting of Amer. Neurol. Assoc., June 18, 1885. JOUR. NERV. AND MENT. DISEASE, xii., July, 1885, pp. 21.

On Two Little Known Cerebral Fissures, with Suggestions as to Fissural and Gyral Names. Amer. Neurol. Assoc. Trans., JOUR. OF NERV. AND MENT. DISEASE, xii., 350–352, July, 1885.

The Paroccipital: a Newly Recognized Fissural Integer. JOUR. OF NERV. AND MENT. DISEASE, xiii., No. 6, June, 1886.

Prof. Wilder has also sent me manuscript notes of a revised list of fissures, presented at the last meeting of the American Association for the Advancement of Science; and to be published with figures in the *American Naturalist*, October, 1886.

[1] "On the Affinites and Differences between the Brain of Man and the Brains of Certain Animals," by George Rolleston, M.D., F.R.S. Two Lectures delivered at the Royal Institution. *Med. Times and Gazette*, vol. l., Feb. 22, 1863, and March 15, 1863, p. 181 and p. 259.

upon each other, what are but connecting spurs in the ape's brain, overhung and concealed by the beetling parietal and occipital lobe, rise in man to the dignity of connecting table-lands, filling up and bridging over levelly what is a valley, or rather a chasm, in most simious encephala." Gratiolet has discussed these bridging or transition gyres under the name of *plis de passage*. He attached great importance to them in the study of the problem of development, and distinguished altogether six of these transition gyres—four external and two internal. The four external pass from the lateral portion of the occipital lobe to join the parietal and temporal lobe. He named the uppermost of these the first or superior external *pli de passage*, and the others, the second, third, and fourth, respectively. The two internal transition gyres he named the superior internal and the inferior internal *pli de passage*. These, according to him, connect the cuneus with the precuneus. Parker[1] has also called attention to the importance of these bridging convolutions in a valuable paper.

Rolleston indicates clearly as follows the chief points in which the human cerebral surface and the cerebral exterior of the ape coincide and differ. The human and simian cerebrum viewed from above presents an ovoid shape, the human blunt, the simian taper; the human outline is irregular from elongation; the outline of the ape conforms more closely to the egg type; the lines limiting the superior edge of the simian brain are all but a semicircle, while below, regularity and evenness have been removed from the lower and become the characteristics of the higher brain; unevenness in the ape's brain is due rather to defect in the development than the reverse; the human brain has more altitude than that of the ape, and is always wanting in internal convolutions; the simian brain is very frequently wanting in external convolutions, filling up certain fissures, especially the external perpendicular fissure; the frontal gyres have in man an enormous development as compared with those in the ape; and it is especially in the uppermost of these that the widest differences are noted.

[1] "Proceedings of the Academy of Natural Sciences of Philadelphia," vol. xxx., 1878, p. 159.

"The occipital lobe is separated from the parietal lobe," says Parker, "by a well-marked transverse fissure, the so-called perpendicular fissure; the mesial portion, corresponding to the fissure known in the human brain as the parieto-occipital, is called the internal perpendicular, while the lateral portion is known as the external perpendicular fissure. In most of the monkeys, such as Cebus, Cynocephalus, Cercopithecus, Macacus, etc., these two fissures are continuous; but in man and the higher apes, such as the Orang, Chimpanzee, etc., they are separated into distinct fissures by the development of a bridging convolution, the so-called superior external transition or connecting convolution, the *pli de passage supérieur externe* of Gratiolet. The same condition is also found in Ateles and Hylobates. In man this convolution is largely developed, and alters, to a great extent, the appearance of this region as found in the ape. This convolution was found invariably smaller, less developed, and simpler in the negro than in the white. In one negro brain it was so imperfectly developed that the internal and external perpendicular fissures were superficially continued. The fissure corresponding to the external perpendicular is also better developed in the negro."

With these facts before us, the peculiarities which probably indicate a low or aberrant type of human brain can be recognized. In general, simplicity of structure, with well-defined and comparatively little-complicated fissures and gyres, point to a low type; simplicity of the frontal fissures and gyres in particular indicates an inferior order of brain. Unusual symmetry and atypical asymmetry are indicative of a low type. Normal human brains present a typical asymmetry. Coming to special details, Benedikt refers to a fissure, which he terms the external orbital, very constant in apes, and not commonly distinct in the human brain, but rarely absent in criminals' brains examined by him. Partial or complete uncovering of the insula, that is, its exposure to sight without pulling apart the margins of the Sylvian fissure, is to be expected in white brains of inferior grade. The Sylvian fissure in the average brain is

of moderate length; the higher the type, other things being equal, the more likely it is to be short. The central fissure in inferior types will be less sinuous, and less likely to be fully separated above from the sagittal or longitudinal fissure and below from the Sylvian. With reference to the central fissure, the question of complete or partial confluence, either above or below, or laterally, is of considerable interest. These confluences are comparatively rare and probably indicative of low type. It seems, however, unphilosophical to speak with Benedikt of a "confluent fissure type of brain." Fissures run together in brains of low organization because of the want of development of connecting or encircling gyres, and the stress should be laid upon this absence of connecting gyres. Bridging of the central fissure has been observed in rare instances. This might be thought to indicate rather a high order of individual brain, since it gives additional convolutional substance, but it is an aberrant or unusual condition. In poorly developed hemispheres the gyres bounding the central fissure will not be sinuous and complicated—that is, will present little elaboration. An unusually well-defined, elongated, or unbridged parietal fissure; a small marginal gyre, as when the parietal fissure approaches closely to the Sylvian; a much elongated, so-called retrocentral (postcentral of Wilder) fissure; and an occipital fissure which opens well out on the lateral surface, with the superior *pli de passage* below the brain level, are probably indications of inferiority. Shortness of the Sylvian fissure, in more highly evolved brains, tends to confer a corresponding shortness in the temporal lobe; the opposite is seen in brains but little evolved. Other peculiar conditions of the temporal lobe seem to be indicative of low type; as great length, particularly of the posterior vertical arm of the supertemporal or parallel fissure, with a tendency to confluence with the Sylvian, occipital, or parietal fissure. Such a tendency indicates a lack of development of Gratiolet's transition gyres of the temporo-occipital and parieto-occipital regions. On the median surface of the hemisphere, some indications of inferiority are smallness of the paracentral lobule and precuneus, confluence

complete or incomplete of the calcarine and hippocampal fissures, and unusual definition of the median portion of the occipital fissure, although, curiously, in a few brains of low type an unusual development of the so-called gyre of the cuneus, or inferior internal *pli de passage*, is observed. This is an aberrant or peculiar condition, certainly not usual in the average human brain.

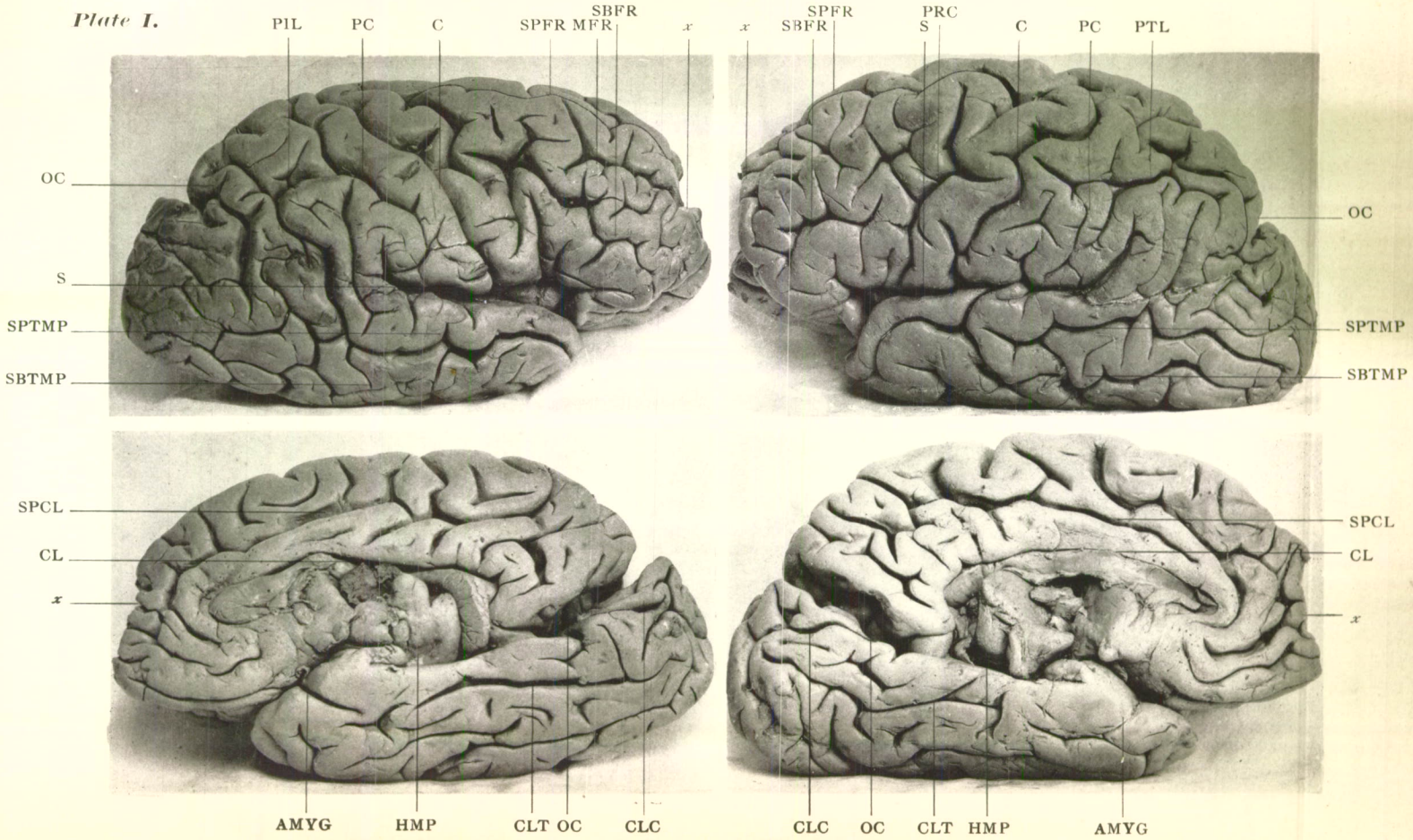
The specimens which I exhibit are: (1) The brain of James Burk; (2) The brain of Joseph Taylor; (3) The brain of a feeble-minded youth. I have also notes on (4) The brain of Dr. L. U. Beach; and (5) The brain of Edward Ford. In addition, I exhibit, through the courtesy of Dr. A. J. Parker, (6) One hemisphere of the brain of a negro; and (7) A Chinese brain.

The first specimen which I exhibit is the brain of a man named Jas. Burk, who was either burned to death or suffocated in the fire which destroyed a large portion of the Insane Department of the Philadelphia Hospital in 1885. He was about 70 years of age at the time of his death. He was admitted to the Insane Department of the Philadelphia Hospital more than twenty years since. It is told of him that forty years ago, in Ireland, he shot a watchman who attempted to arrest a friend, and fled to America to escape punishment. In 1856, or about then, he attempted to cut his throat, and, a few months later, killed a man and a woman who were employed as cooks in the hospital. He was evidently a delusional lunatic who believed that it was his duty to kill. He sometimes said that he was followed by an evil spirit who carried a long chain, and when this spirit said "kill" he felt that he must. After the killing of the cooks he was, for a time, especially violent and dangerous. For two years he was shackled with heavy chains, and after these were removed his hands were kept muffled. After the removal of the chains he believed that both his legs were cut off, and walked about with great caution for fear of injuring himself. He sometimes asserted that if his hands were free he would kill anybody that came in his way. He was a finely built man and is said to have had a remarkable memory.

In Plate I, we have two views of each of the hemispheres of the brain of Burk—from the dorso-lateral and meso-ventral aspects. The lettering corresponds with the nomenclature of Wilder. A careful comparison of the following description, with the figures and symbols, will serve to bring out the peculiarities of the brain. Small blocks of brain tissue were removed for microscopical examination from the tips of each frontal lobe at *x*. The photographs were made after the brain had been hardened in zinc chloride and alcohol. Fissures only have been indicated, in order to save too much interference with the appearance of the phototypes. The letters are those given as abbreviations by Wilder.

In the *right hemisphere* of the brain of Burk the Sylvian fissure is distinctly shorter than the corresponding fissure of the left hemisphere. The insula is exposed in its anterior portion with the brain in ordinary position, although it is not as distinctly visible as in the brain of the feeble-minded youth and the negro, which I will exhibit later. The central fissure is confluent with the Sylvian. The central gyres are well developed, except a depression about the middle of the precentral gyre, where is shown a tendency to confluence with a vertical secondary branch of the superfrontal fissure. The precentral fissure is short and does not communicate with the Sylvian, but is confluent with the subfrontal fissure. The right frontal lobe presents three well-defined fissures running in a sagittal direction, corresponding to the superfrontal, subfrontal, and medifrontal fissures of Wilder, and giving, if these are regarded as primary fissures, four well-demarcated gyres (the four frontal gyres of Benedikt). Otherwise the markings of the frontal lobe are comparatively simple. The orbital surface shows in addition to the common H-shaped or zygal fissure, an exact duplication of this H-shaped fissuration, anterior to it, and also a well-marked fissure sagittal in direction external to both H-shaped fissures (the external orbital fissure of Benedikt). The parietal fissure is in two parts, the separation being by a narrow gyre which apparently corresponds to the second external *pli de passage* of Gratiolet. The posterior branch of the parietal fissure (paroccipital of Wilder) almost completely merges with the occipital fissure, from which it is separated only by a very much depressed anterior arm of the superior *pli de passage* of Gratiolet (first occipital gyre of Ecker, paroccipital of Wilder). This posterior branch of the parietal communicates with a well-marked transverse occipital. The so-called retrocentral fissure (postcentral of Wilder) is large and clearly defined. Both the parietal and marginal gyres are well developed. The angular gyre is small. The occipital fissure shows in itself, and

Plate I.



BRAIN OF JAMES BURK.

in its communications and surroundings, marked ape-like conditions. As already stated, it partly communicates with the posterior branch of the parietal, the superior external annectant gyre being very small and much depressed in its anterior portion. The posterior gyral margin of the occipital fissure has a true pent-house appearance. The medioccipital and suboccipital gyres are well demarcated by fissures which are in the same lines with the supertemporal and subtemporal fissures. The calcarine fissure is crossed about its middle by a narrow gyre. The occipital, the calcarine, and the hippocampal fissures are almost completely confluent. The collateral fissure and its bounding gyres are well defined and simple in type. The supertemporal fissure is clearly defined, its posterior ascending arm being nearly confluent with the parietal fissure. The four fissures of the temporal lobe are all particularly well marked, reminding one of the diagrammatic representations of Ecker. Wernicke's fissure [1] is well defined, communicating with the supertemporal and subtemporal fissures. The supertemporal gyre narrower than usual, particularly in its anterior half. The supercallosal fissure is well defined, with a shallow bridge about the junction of its middle and posterior third. The inflected, the precuneal, and the amagdaline fissures of Wilder are all well shown in this hemisphere.

In the *left hemisphere*, the Sylvian fissure is longer than on the right side. The insula is exposed, but not as much so as on the other side. The central fissure shows a superficial tendency to confluence with the Sylvian, but the two are separated by a small bridge. The precentral and postcentral gyres are both strongly developed. The left frontal lobe is not clearly separated, like the right, into four gyres by three distinct fissures. The superfrontal fissure and subfrontal fissure are well outlined, but in place of the medifrontal fissure which is present on the other side, is an undulating arrangement of fissures and gyres. The super- and subfrontal gyres are well demarcated and simple in aspect. The orbital fissuration is similar to that on the other side, except that the fissures are deeper and more elongated. The parietal fissure, as on the other side, is in two parts separated by a small sunken gyre near its middle. The posterior branch of the parietal is connected with an illy defined transverse occipital. The superior external *pli de passage* is narrow in both of its arms and slightly depressed, but the depression and pent-house appearance are not so marked as on the other side. The retrocentral fissure (postcentral) is poorly outlined. The medioccipital and suboccipital gyres, with their corresponding fissures, are well defined. The calcarine fissure is crossed by a bridge below the surface. The occipital, calcarine, and hippocampal fissures show the same tendency to confluence as on the other side, but the hippocampal is separated from the other a little more completely, although by a depressed gyre. The collateral and subtemporal fissures are

[1] This fissure will be more fully discussed when the brain of Taylor is exhibited.

strongly outlined, as are also the subcalcarine, subcollateral, and subtemporal gyres. The cuneus in this, as in the other hemisphere, is small. The supertemporal, or parallel fissure presents a very unusual appearance : instead of being, as it is commonly, a long, deep, unbridged furrow, it is divided about the middle of its infra-Sylvian portion into two parts by a comparatively large gyre. The posterior extremity of its anterior division runs superficially into the Sylvian. The supertemporal gyre is unusually narrow in its anterior and posterior portions. The angular gyre is also narrow. The subtemporal fissure is long and well defined, reaching into the occipital lobe. Wernicke's fissure is small and not well defined. The supercallosal fissure is well marked, but is separated into two parts, the anterior portion forming a fissure similar to the posterior, giving the appearance on the median surface of two supercallosal fissures, one above and somewhat anterior to the other. The inflected, the precuneal, and the amygdaline fissures of Wilder are well shown in this as in the other hemisphere. The inflected fissure in particular forms a deep indentation. The precuneus is of fair size, and is strongly marked with fissures.

In brief, the most striking indications of inferiority in the brain of Burk are the comparatively simple type of the frontal lobes ; the partial exposure of the insula ; the confluence of the right central with the Sylvian fissure ; the confluence, almost complete on the right and less perfect on the left, of the calcarine with the hippocampal fissures ; the ape-like similarities shown by the annectant gyres of both sides ; the shallowness, shortness, and complete bridging of the right calcarine fissure ; the imperfect angular gyre of one side ; and the simplicity of the temporo-occipital and parieto-occipital regions.

A cast was made of the skull of Burk, and this showed, among other things, that the right anterior, middle, and posterior fossæ were more capacious than the left. The calvar was also decidedly asymmetrical, the left side being more capacious than the right.

The confluence of the right central with the Sylvian fissure in this brain is worthy of particular attention. Benedikt claims that in thirty-eight cerebral hemispheres he found this complete union eighteen times. These results are startling, when it is considered that prior to the observation of Benedikt very few instances of confluence of these two great fissures had been reported—among others, one by McDonald, Parker, and myself respectively. In Zernoff's collection of one hundred brains, referred to by Benedikt, it occurred in but one instance. Ecker states that he had never seen an example. Since the publication of Benedikt's work, Osler has reported that out of sixty-three hemispheres, from thirty-four individuals, he found the central fissure communicating with the fissure of Sylvius three times completely and seven times incompletely.

The second brain is that of a man named Joseph Taylor,

who killed one of his keepers while serving a term in the Eastern Penitentiary, Philadelphia. He was defended on the plea of delusional insanity, but was convicted of murder in the first degree and hanged. Dr. H. C. Wood, H. Preston Jones, and myself, were retained as medical experts for his defence. He was, I believe, a delusional monomaniac of the criminal or prison type. His delusions chiefly had reference to the putting of injurious or poisonous medicines into his food or drink, and to persecution and bad treatment by the warden, keeper, doctor, and prison officials generally. Articles upon his case have been published by Dr. Wood and myself.[1]

This brain was first exhibited and verbally described by Dr. A. J. Parker, at the Philadelphia Neurological Society. In *The Polyclinic* for September, 1886, a plate is given, showing four views of this brain.

The brain of Taylor shows, in the first place, a difference in bulk and in the general appearance of the two hemispheres. The right hemisphere is shorter and higher than the left. The fissural and gyral conformation in general is of comparatively simple type, both hemispheres showing many ape-like and fœtal similarities.

In the *right hemisphere* the Sylvian fissures is more vertical in direction than is usual ; both its anterior and posterior arms being well defined. The insula is barely exposed at its anterior part. The central fissure is unbridged, not confluent, and very slightly sinuous. The precentral and postcentral gyres are moderately well developed ; the precentral fissure is confluent with the Sylvian and also with the subfrontal. The entire frontal lobe has an unusual simplicity of aspect, and it is so fissured in a sagittal direction as to give, like one hemisphere of Burk's brain, an appearance of four gyres. The superfrontal fissure is straight, and clearly defined, with a larger posterior vertical secondary branch. The subfrontal fissure is also well defined. All the frontal gyres are comparatively simple, with short secondary markings. The parietal fissure, beginning close to the Sylvian, extends uninterrupted upward and across the parietal lobe into the transverse occipital of Ecker. Its beginning portion is so developed as to constitute a well-marked postcentral fissure. The marginal gyre is small and narrow. The occipital fissure is wide on the median surface, and notches also the lateral surface very distinctly. The superior external annectant gyre (paroccipital of Wilder, superior occipital of Ecker) is well up to the brain level. The superior in-

[1] JOURNAL OF NERVOUS AND MENTAL DISEASE, vol. xi., No. 4, Oct. 4, 1884, and *The American*, vol. ix., p. 88.

ternal annectant and inferior internal annectant gyres (gyrus cunei), can both be distinctly and separately made out, although well below the surface of the cuneus and præcuneus; they arch downward acutely with longer posterior than anterior arms. This development of the inferior internal annectant gyre causes a partial separation between the occipital and calcarine fissures. The calcarine fissure extends to the extremity of the occipital lobe, communicating in front imperfectly as just stated, with the occipital, but completely with the collateral fissure, giving this portion of the brain a most unusual appearance, as if the whole of the occipital and occipitotemporal regions, on the median and lower surfaces, were cut off from the parts of the brain anterior. The supertemporal fissure is well marked and has a short posterior vertical arm, which terminates just below the posterior extremity of the parietal fissure. The meditemporal fissure is short. This fissure communicates with a very well-defined, almost vertical fissure, which separates the temporal from the occipital lobe.[1] The supertemporal as well as the meditemporal fissure communicates with this fissure, the vertical extension of the supertemporal fissure being, in fact, continuous with it. The orbital fissuration is radiate, showing four radii, and one secondary fissure between the orbital and the olfactory. The olfactory fissure merges distinctly with the basisylvian. With the exception of the collateral fissure, which communicates with the calcarine, the lower portion of the temporal lobe is difficult to describe, being atypical in its markings. The supercallosal fissure is continuous, its posterior arm turning up just behind the central fissure and strongly indenting the median edge of the hemisphere. Above the supercallosal fissure the median surface of the hemisphere presents a succession of shallow parallel, chiefly vertical markings, the vegetative repetitions of Parker.

In the *left hemisphere*, as on the other side, the insula is barely exposed in front. The central fissure is straight, uninterrupted, and separated from the Sylvian or sagittal fissures, but is superficially confluent with the superfrontal fissure. The precentral gyre is wider and more fully developed than the corresponding gyre of the other hemisphere. The precentral fissure is well defined, but not confluent with the Sylvian as on the other side. The markings of the frontal lobe are simple, although a little more complicated than upon the other side. The four frontal gyres of Benedikt are not so readily made out. The superfrontal fissure is well marked. The orbital fissuration is more irregular than in the right

[1] This fissure is what has been termed by Benedikt Wernicke's fissure; and Benedikt says that the meditemporal gyre is always situated in front of it. He describes the fissure as lying in an imaginary arc situated between the occipital fissure above and the meditemporal fissure below. It corresponds to the inferior portion of the external perpendicular fissure in the ape. Parker, in an unpublished paper, proposes to call this the occipito-temporal fissure. It is better defined in the brain of Taylor than in any human specimen that I have ever seen, easily demarcating the parietal and temporal lobes from the occipital upon the lateral aspect of the hemispheres.

hemisphere: instead of a distinctly radiate or H-shaped appearance, one deep fissure extends antero-posteriorly with two posterior arms, giving a Y-shaped fissuration, the arms of the Y being towards the Sylvian fissure. The parietal fissure, beginning between the central and the posterior arm of the Sylvian, extends backward to the transverse fissure of Ecker, with only one bridge well below the surface at its anterior part. The marginal gyre is small. The occipital fissure is well developed. The superior external annectant gyre is level with the brain surface. The inferior internal annectant gyre can be barely made out. The calcarine fissure does not communicate with the collateral as on the other side; it is not confluent with the hippocampal. The cuneus is distinctly smaller and of a different shape from the cuneus of the right hemisphere. The collateral fissure and its adjoining convolutions can be better made out than on the opposite side. The supertemporal fissure is well defined. On this side, as upon the other, Wernicke's fissure is clearly outlined, communicating with the supertemporal. The supercallosal fissure of this hemisphere is continuous. Above it are both horizontal and vertical markings, somewhat different in appearance from those of the opposite side.

The third specimen, the brain of a feeble-minded youth, was obtained from one of three cases of progressive muscular degeneration, described in a paper presented by Dr. I. N. Kerlin and myself to the American Medical Association in 1879, and printed in the transactions of the Association for that year. The brain exhibits, among other things, the superior external *pli de passage* of one side sunk below the surface, the next fold partially covering it.

I have made some studies in cerebral morphology at the Pennsylvania Training-School for Feeble-Minded Children. Photographs of some brains there studied I present, through the kindness of the superintendent, Dr. I. N. Kerlin. Dr. A. W. Wilmarth, assistant superintendent of this institution, has published, under the title of *Notes on the Pathology of Idiocy*,[1] descriptions of the arrangement of the gyres and fissures of several idiot brains.

In the arrangement of the gyres some of the most striking peculiarities were found. In congenital idiocy and imbecility, particularly when of a low grade, the difference in gyral arrangement was great. Simplicity, especially in the frontal regions, was the rule. The frontal lobes were often

[1] *Alienist and Neurologist*, vol. vi., No. 3, July, 1883.

narrow and pointed. Wilmarth says of one variety of brain, that it may be well called the atypic brain. An extreme case of this kind was a brain in which the callosum was wanting.

Dr. L. U. Beach was executed at Hollidaysburgh, Pennsylvania, February 12, 1885. His brain was sent by Dr. Smith, of Altoona, to Prof. James Tyson, of the University of Pennsylvania, for examination. When it arrived the lower portions of the brain were much softened and decayed, so that it was impossible to study thoroughly the lower temporo-occipital and basal regions. The other portions of the brain had also undergone some change, but were sufficiently well preserved to allow of a study of fissural and gyral arrangement by Drs. Tyson, Parker, Lloyd, Dercum, and myself. The case of Beach attracted much attention in Pennsylvania and throughout the country, and papers on it have been published by Clark Bell, Esq., Dr. E. C. Mann, and others. The crime for which he suffered the death penalty was the killing of his wife in 1884. The history of the patient's family was filled with evidences of imbecility and insanity. Strong evidence as to his insanity was brought at his trial and subsequently. The circumstances of the commission of his crime were extraordinary. Beach walked to the house of his wife's brother and told him that he had killed his (Beach's) wife, who was found with her head nearly severed from her body, and with other deep cuts. Beach said that he only remembered that an immense snake seemed about to attack him, and that he was compelled to cut off its head.

The *right hemisphere* of the brain of Beach showed the fissure of Sylvius and central fissure separated by a very small gyre. The insula was exposed and large, having six gyres and five fissures. The frontal lobe was of simple type. The subfrontal fissure had two fully developed bridging gyres, a fœtal condition. The super and medifrontal gyres were well defined ; the subfrontal, narrow and slightly arched ; the secondary markings of the frontal lobe unusually simple ; the precentral gyre simple and unusually narrow. The precentral fissure ran superficially into the Sylvian and more deeply into the subfrontal. The orbital surface presented a single fissure parallel with the olfactory, instead of the usual triradiate or H-shaped fissure. The upper extremity of the

occipital fissure almost merged with the parietal. An unusual condition was an easily-determined superior internal annectant gyre arching inwards and downwards on the median surface.

According to Bischoff, as stated by Parker, the superior external and the superior internal annectant gyres are identical. Ecker, however, opposes this view, holding that in the brains of various apes both are clearly developed, and that also not infrequently in man a gyre which rises at the posterior extremity of the precuneus with the superior external gyre runs backward in an arch convex inward and downward, while the superior external gyre makes an arch outward, the two gyres again coalescing in the cuneus. I was inclined to adopt the view of Bischoff, not having observed, in any specimens examined, a clearly-defined superior internal gyre until the specimen from Beach was observed.

The inferior internal annectant gyre was feebly developed. The parietal fissure was long and well marked, having a single small and bridging gyre, and communicating with a moderately well-developed transverse occipital fissure (paroccipital of Wilder). It communicated superficially with the Sylvian fissure. The postcentral fissure was large and well defined, and the parietal gyre of nearly the average size. A well-marked secondary fissure crossed the marginal gyre vertically, branching from the parietal fissure and communicating superficially with the supertemporal. The supertemporal fissure was remarkable in that it was completely confluent with the Sylvian fissure, extending from the point of the confluence as a deep, well-defined trench backwards and upwards nearly to the sagittal fissure, crossing and confluent with the parietal.

In the *left* cerebral *hemisphere* the Sylvian fissure, which was more nearly vertical than usual, passed upwards to within about an inch of the sagittal fissure, a remarkable aberration. The central fissure presented, at the junction of its middle and lower thirds, a well-marked bridging convolution. The insula could be readily seen without separating the margins of the Sylvian fissure.

Edward Ford, a negro, about sixty-five years old, was sentenced to death for murder, but was never executed, successive governors, for some reason, refusing to sign the warrant for his execution. Two or three years before his death, and subsequent to the appearance of some paralysis of the left side, he was pardoned, and soon after sent to the nervous wards of the Philadelphia Hospital, where he remained until the day of his death. He was a quarrelsome, peculiar man, in the habit of drinking, before the commission of his crime. During his stay in the hospital he was clearly out of his mind. The paralysis of his left side became quite profound before his death. The brain

of Ford was exhibited at the Philadelphia Pathological Society in 1882, and a brief account of it published in the *Philadelphia Medical Times* for May 20th, but its morphological peculiarities were not detailed.

I was assisted in my examination of this brain by Dr. James Hendrie Lloyd.

In the brain of Ford the insula was visible on both sides without pulling apart the Sylvian fissure. The Sylvian fissures were more nearly horizontal in their anterior portions than is usual in the white brain.

I will describe first the *left hemisphere*. The superfrontal fissure was deep, well defined, running from the anterior tip of the hemisphere backward to the precentral gyre, with one bridge at about the junction of the first and second thirds. The medifrontal fissure was less well marked, although easily recognized, and was nearly confluent with the first about its middle, the two being separated only by a shallow bridge. The precentral fissure was well defined and crossed at right angles by a large secondary fissure. The presylvian, or ascending branch of the Sylvian fissure, was also well marked. The gyres of the frontal lobe were more readily defined than is usual in white brains. The central fissure was a deep, unbridged, comparatively straight furrow, not confluent with any other fissure. Both central gyres were simple in type. The parietal fissure ran from the junction of the lower and middle thirds of the postcentral gyre, curving backwards to a point only about one half inch from the extremity of the occipital lobe. It had only one slight, bridging convolution which did not come to the surface. The superior external annectant gyre (paroccipital of Wilder) was depressed. The transverse occipital fissure was well developed. The supercallosal fissure was divided almost exactly into thirds. In the paracentral lobule was a deep Y-shaped depression. Above the supercallosal fissure ran a series of short, parallel fissures almost the entire length of the supercallosal itself. The supertemporal fissure was a deep, straight furrow bending up abruptly one fourth inch back of the Sylvian fissure. The meditemporal fissure was unusually well defined, as indeed were all the temporal fissures and gyres. The hippocampal communicated with the calcarine fissure.

The *right hemisphere* showed a marked pathological condition—one of atrophy. The postcentral gyre of this side was only about one half the width of that of the left side. The precentral and the parietal gyre were also visibly atrophied. The cerebellar hemisphere of the opposite side was also uniformly atrophied. This pathological condition may have rendered somewhat uncertain the morphological comparisons. The medifrontal fissure was unusually well defined, running back without a bridge nearly to the paracentral. The subfrontal fissure was also straight, short,

and better defined than usual. The central fissure was separated from the Sylvian by a narrow, shallow bridge. The parietal fissure, unlike that of the left hemisphere, at its anterior extremity, formed, an unusually well-marked postcentral fissure. There was an unusual depression or absence of gyral substance in the parietal gyre. The supercallosal fissure of the right side was not divided into thirds as upon the left, but was a deep, continuous furrow with a very slight bridge, far below the surface, near its middle. On the whole this brain presented, in a marked degree, the peculiarities observed by Parker in his study of negro brains, with a more than usual atypical a symmetry of the hemispheres.

The single hemisphere of a negro brain which I exhibit is one of a number examined and described by Parker,[1] who has made a special study of the cerebral convolutions of the negro brain. He has found, as in the Hottentot Venus of Gratiolet and the Bushwoman of Marshall, that the island of Reil was distinctly visible in the normal condition of the brain. This was well marked in some negro brains, and therefore he justly concluded it to be characteristic of the race. In the brain of a mulatto the same peculiarity was present, although not so marked. This condition is not found in the adult brain of any monkey described up to the time of Parker's contribution. The Sylvian fissures of the negro brain, instead of ascending in the usual oblique upward and backward direction, were found by Parker—again as in the Bushwoman and Hottentot Venus,—to assume at their anterior portion a horizontal direction, the posterior portion taking a direction nearly perpendicular to this. He found the average length of the Sylvian fissure in 19 white brains to be $3\frac{5}{8}$ inches; in 13 negro brains, 3 inches; in the mulatto, $3\frac{1}{4}$ inches. The frontal gyres were, as a rule, simpler and better marked in the negro than in the white, the lower seeming to be as well defined as the upper. The central fissure was simpler, straighter, and less undulating in the negro than in the white, its bounding gyres partaking of the same character. The parietal fissure was found remarkably well developed and more tortuous than in the white. In five instances it was not bridged over at any point, presenting the same appearance as in the higher apes, except that

[1] "Proceedings of the Academy of Natural Sciences," Philadelphia, vol. xxx., 1878, p, 11.

its direction was more curved. In six cases only one bridging convolution existed, and in the remaining two one well developed and another imperfectly developed. In the mulatto this fissure was continuous, but much more undulating and tortuous than in the negro. The parietal and marginal gyres were simpler and less marked with secondary fissures than the white. In one negro brain, the specimen which I exibit, the marginal gyre was entirely absent, the brain showing a deficiency in this region greater in proportion than is found in apes. The parietal fissure in this case ran directly into the upper end of the Sylvian. In the occipital lobe he found that the negro brain displayed its ape-like peculiarities to a greater extent than in any other portion of the cerebral surface. The superior external transition or connecting gyre of the occipital lobe he had found invariably smaller, less developed, and simpler in the negro than in the white.

In all of the specimens atypical symmetry as to gyral and fissural development is present. Undoubtedly in normal brains, even of individual of great capacity, marked asymmetry is sometimes found. Some of the features which may constitute atypical asymmetry are the following: the existence of a Sylvian fissure shorter on one side than the other, both absolutely and comparatively, and also a more vertical direction of the fissure on one side than on the other; greater exposure of the insula on one side, with marked differences in the development of its fissures and gyres; confluence of the central fissure with the Sylvian on one side only, and great tortuosity, or bridging of the former fissure in one hemisphere; unusual narrowness, straightness, or complication of the precentral or postcentral gyres on one side; marked differences in the simplicity or complexity of the frontal lobes; great simplicity of the orbital surface on one side; difference in the parietal fissure as to length and interruptions; a smaller parietal, or marginal, or angular gyre on one side; very great differences in the degrees of confluence and interruption of the fissures in general; exceeding great length vertically of the supertemporal or parallel fissure on one side; unusual differences in the size of the precuneus and cuneus.

The autopsy of Guiteau showed, among other things, well-marked atypical asymmetry of the hemispheres. Great differences were found between the insulas and between the fissural and gyral conditions of the median surface of the two hemispheres. The right postcentral gyre was much narrower than the left. The parietal region was flattened, and the right paracentral lobule was quite small as compared with the left, which was large and well developed.

The comments of Spitzka [1] have a certain applicability in the explanation of the peculiarities of the specimens here described.

"Asymmetry of the character found in Guiteau's brain," he says, "is congenital, and differs from the atrophy of one hemisphere, which is known to be the result of various acquired disease processes. In the latter case, as long as any convolutional type can be distinguished in the smaller hemisphere, it deviates no more from that of the opposite side than one hemisphere usually differs from the other in normal subjects. And when a destructive lesion is associated with the atrophy, the former manifests its past existence by unmistakable signs. It is to be further stated that a lack of development of one hemisphere, manifesting itself in a reduction of important gyri and lobes, and combined with an atypical course of a fundamental fissure, must have its origin in an aberrant development instituted at an early period of fœtal life. It is this fact which lends such atypical developments their peculiar significance. Destructive lesions may occur in the postnatal period, a whole hemisphere may be destroyed without necessarily producing insanity; in fact, the further advanced towards maturity the individual is, the better able is the cerebral mechanism to endure extensive injuries without reacting in the direction of pronounced mental derangement. But the nearer the time of the injury approaches the natal period, and still more true is this if it anticipates that period, the less likely is it to leave the mental mechanism intact. An aberrant development is in this respect analogous to an early injury, but with this difference, that while the injury is limited in its effects to the functions of the special region destroyed, irritated, or hampered, it is impossible to say how deeply the error in development, manifesting itself in a surface anomaly of the hemispheres, may involve that subtle architecture of the transmitting and associating tracts which a newer and rational psychology teaches us to regard as the basis of the logical mechanism. It is in harmony with this explanation that aberration in development, of the kind discovered in Guiteau's

[1] *American Journal of Neurology and Psychiatry*, vol. i., 1882, p. 386.

brain, has not yet been found in others than persons of unsound mind. The unsoundness associated with such analogous errors of brain development covers an extensive range, including 'original,' or congenital and hereditary, imbecility, and chronic insanity with systematized delusions, morbid projects, and moral perversion. The most reliable and thorough investigators, such as Starke, Schuele, Sander, Muhr, and Jensen, have noted the presence of convolutional anomalies and asymmetry in such subjects; and in a work of no less prominence than Ziemmsen's Cyclopædia, the author of the article on insanity expresses it as his belief that the only finding in the brains of constitutional lunatics of monomaniacal tendencies (Primär Verrückte) which promises to establish a relation between the insanity and the state of the brain, consists in such architectural anomalies."

Striking differences can be detected between these brains and what is commonly regarded as the average normal human brain, and the brain of high development. Here we have the brain of Burk, recognized by all as a delusional lunatic; of Taylor, whose life was a sickening tale of lust and violence; of a feeble-minded youth, the victim of a form of neuro-muscular degeneration; of Beach, who showed evidences of imbecility, paranoia, and epilepsy; and finally of Ford, an ignorant negro, with a record both of criminality and insanity. In all these brains are points of affinity which put them in a class together; in an emphatic sense they represent the brains of low and aberrant development. The specimens taken from individuals of the white race exhibit negro, simian, and fœtal similarities, resemblances, and reversions in an unusual degree. With reference to the criminals, or so-called criminals, of the series, it may be said that to conclude from such a study that the brains of all criminals are distinctive, that we have a "criminal type" of brain which can even be separated from that found in cases of idiocy, imbecility, paranoia, and other illustrations of psychical degenerative states, is not a truly philosophical generalization. The proper ground to take is probably that indicated by Kiernan and others, namely, that between the true criminal type, the idiot, the imbecile, and the paranoiac, the psychologicalrel ations and their anatomical bases are intimate and close.

The truth is that some idiots and paranoiacs have much

in common. Benedikt's position may have been partially misunderstood by some of his severest critics. What he does say in his preface to his book on the *Brains of Criminals*, is that crime is in no way analogous to monomania; that it results from the physical organization as a unit, and that its particular form of expression is determined by social circumstances.

To attempt to construct a theory as to the anatomical basis of crime is, in some respects, unphilosophical. Crime being technically the transgression of the law, criminals must be of the most diverse character. Almost any one may become a criminal under the stress of peculiar circumstances, and therefore he who would attempt, in a general sense, to establish a criminal type of brain might be led into gross error; but no matter what subdivisions of criminals may be made, a certain number will always be found who are criminals as the result of their organization, because of retarded, defective, or aberrant brain development. Whether even such criminals should be technically regarded as insane, is a further question; certainly all of them need not be so classified; more certainly many of them must be so classified.

Some authorities are strongly inclined to doubt whether studies of this description into the gross peculiarities of gyral and fissural development, or of any other gross abnormalities, can give us any result of value, so far as determining the mental type of the individual. Clevenger is inclined to doubt whether a special study of criminals' brains would afford any results apart from investigations among any other classes of men.

The error should not be on either side. On the one hand, we should not, with Benedikt, and his followers and admirers, fall into the error of supposing that we have an almost absolutely fixed type of criminal brain; on the other hand, we should not be too broad in our denunciations of those who look to a study of original organization for their conclusions as to the mental state and responsibility of those who commit crime. If we admit with physiologists and anthropologists that a certain number of the people of

this world are criminals as the result of inherited organizations, in that admission we show the necessity and the great value of studies into the conditions of brain development.

Dr. Johann Badik has for a number of years occupied himself with the question of the skulls and brains of criminals. His results were published in Virchow's Archives, and were summarized in 1884, by Dr. J. C. Wilson.[1] His investigations were conducted in the great Hungarian prison at Illava. Dr. Badik classified criminals into four typical groups, a division based upon the association of certain mental and moral qualities with definite abnormalities in the skull and corresponding lesions in the brain and its coverings. Anatomically the groups arranged themselves into: first, those with symmetrical skulls; and, second, those with asymmetrical skulls. Under symmetrical skulls he found, first, those with small developed skulls without pathological changes anywhere. These were simple-minded persons with evident and incurable lack of mental development and moral perception. Second, were those with skulls of medium development, with lesions of the brain and its membranes. These individuals were intellectually more developed; they improved mentally and morally; and their crimes were usually committed as the result of emotion, temptation, or necessity. Under asymmetrical skulls were included, first, those in whom the brain and its membranes showed no pathological changes. Badik forcibly asserts that the majority of the inmates of the prison presented this skull malformation. These were the incorrigible criminals, who were benefited neither by instruction, counsel, religion, punishment, nor any thing else. They belonged to the class of cases represented by some of the individuals from whom the brains here described were taken. Under asymmetrical skulls a second class of cases was found in which with the asymmetry were associated pathological changes in the brain and its coverings. These criminals had the conditions of faulty development shown by the last class, and, in addition, pathological changes. They were often epileptic;

[1] *Philadelphia Medical Times*, vol. xv., Oct. 18, 1884, p. 50.

their crimes had been committed for the most part, if not indeed always, in a state of perverted consciousness, and were remembered only as a dream.

In these last two classes belong those of whom Dr. J. S. Wight[1] strongly discourses as follows: "The concurrent and unanimous testimony of those who are, from their experience and their knowledge, most competent to judge, is: That the great under class of criminals have more or less defective organizations, especially as relates to their nervous system, and more especially as relates to their brain; that they are more or less deficient in moral sense, showing in this respect the lack of development or the results of decay, the best and last-developed sense, the moral sense, disintegrating first of all; that they are perversely wicked and indomitably inexpedient, committing crimes when doing right would be of more use to them; that they are as passionate as the wild beasts of the forests, and as restless as the ocean that heaves at every gust of the wind; that they are at war with mankind and ever in commotion with themselves; that they are, like the ship, beaten about by the storm—the ship without compass, rudder, or captain; that they are formed and fashioned by the hand of an evil genius, whose name is bad heredity, and whose hand-maid is ignorance; and that they cannot be very much reformed, and that their reformation ought to have been begun in their ancestors."

In concluding this paper I desire to make a few special remarks in connection with the consideration of the peculiarities of fissuration presented by the specimens exhibited. More particularly I wish to call attention to the views of Dr. A. J. Parker with reference to the vegetative repetition of cerebral fissures. Parker,[2] after considering the question whether the fissures of the cerebro-cortex are due to mechanical causes entirely, or represent lines of retarded growth, or arise through both of these methods, discusses the question whether we are to regard each fissure as produced by a distinct and separate process of formation, or

[1] *American Journal of Neurology and Psychiatry*, vols. ii. and iii., p. 135.

[2] "Proc. of Acad. Nat. Sci. of Philadelphia," vol. xxx., page 148.

that some of the fissures are only repetitions of fissures previously formed.

"In studying the cerebral fissures as presented in the brains of different animals," he says, "especially amongst the Carnivora and Ungulata, it had appeared to him that many of the fissures should be regarded in the latter light, that is, as vegetative repetitions. Viewed in this way, many difficulties in regard to the identification of homologous fissures in different brains disappear. According to the mechanical theory, a deep and distinct fissure having been formed, there would be a tendency to produce other fissures following the same general direction, and having the same general appearance, and depending for their formation on the one originally laid down. According to the view that fissures are the result of retarded cerebral growth, we may expect to find, especially in lower forms of brains in which much fissuration exists, vegetative repetitions of the same lines of growth. In either case the fissures which appear after the original fissure, and which follow its general contour, should be considered as belonging to one group with that fissure, and to be of secondary importance in relation to it. Hence, in many cases, instead of seeking fissures separately homologous to each other, we will be obliged to consider certain groups to be homologous to certain other groups, the number of separate fissures of which may be more or less numerous. Owen, in founding his nomenclature of the cerebral fissures in the Carnivora and Ungulata, gave a distinct and separate name to each fissure, and he endeavored to point out the homologue of each of these in different brains. If, however, we are to regard that at least some of these fissures are entirely secondary and to be considered as merely vegetative repetitions, then we must not seek, nor is it possible to find, homologues for each fissure, even in closely related brains."

Parker gives various illustrations of these vegetative repetitions found in his studies of the Carnivora and Ungulata. He also studied these fissures in monkeys and apes and in the negro. In all of his investigations the supercallosal or calloso-marginal fissure was particularly considered. In the

monkeys and apes, as in lower forms, he found a marked tendency in this fissure to split up in two or more similar fissures. In man it often consisted of several distinct parts. He had observed that the repetition of this fissure was especially regular and well marked in the brain of the negro. It is very observable in connection with several of the hemispheres studied in this paper; and supposing this view as to vegetative repetition of fissures to be generally applicable in a study of the cerebral surface, many examples can be found in various localities, more particularly upon the orbital surface and in the temporo-occipital region.

This view of the subject of cerebral fissuration is important in connection with the question of new fissural integers, to which Prof. Wilder has recently given so much attention. To cite but one example, Wilder regards the supercallosal fissure, which Parker has carefully studied, as not being a good fissural integer. At some future time I hope to be able to consider this question of new fissural integers more at length.

Although in the paper, partly from necessity and partly from choice, I have confined myself to a study of gyral and fissural arrests and aberrations, I wish emphatically to call attention to the fact that it is not by a study of fissures and gyres alone that the entire truth can be determined with reference to the questions of capacity, intelligence, and responsibility of the individuals whose brains are the subjects of examination.

In our more perfect studies we must go further and deeper than this. As shown by Turner, we must study the depths of fissures, the thickness of gray matter, the quality of tissues. The microscope must lend its help. It would be a most interesting, valuable, and thoroughly scientific investigation to take a human brain of the kind exhibited, and with it make an elaborate painstaking investigation from every point of view. Such specimens should be prepared carefully by a method of hardening which would allow, subsequently, both microscopic and megascopic investigation to be thoroughly made. The plan of study should be to first compare weights and general

features of the hemispheres; to examine lobes, fissures, and gyres; to study questions of simplicity and complexity in fissural and gyral development; to ascertain the relations and degrees of development of annectant gyres, and all other special points in cerebral topography. Great sections should be prepared with large microtomes, and these should be examined and comparisons made of sections of different hemispheres and different positions in the same hemisphere. Differences in ventricles, the condition of the ganglia, capsules, and corpus callosum, the relations of the cerebellum to the cerebrum, the size and development of the peduncular tracts, and of the tracts and centres in the pontile and oblongatal regions should be carefully studied. Such careful and elaborate work, although it required weeks, or months, or years, for its thorough accomplishment, would be of inestimable value to anthropology and medicine, and would reward with abundant laurels the patient and careful investigator.

III.

PRELIMINARY STUDY OF A CHINESE BRAIN.[1]

By A. J. PARKER, M.D., and CHAS. K. MILLS, M.D.

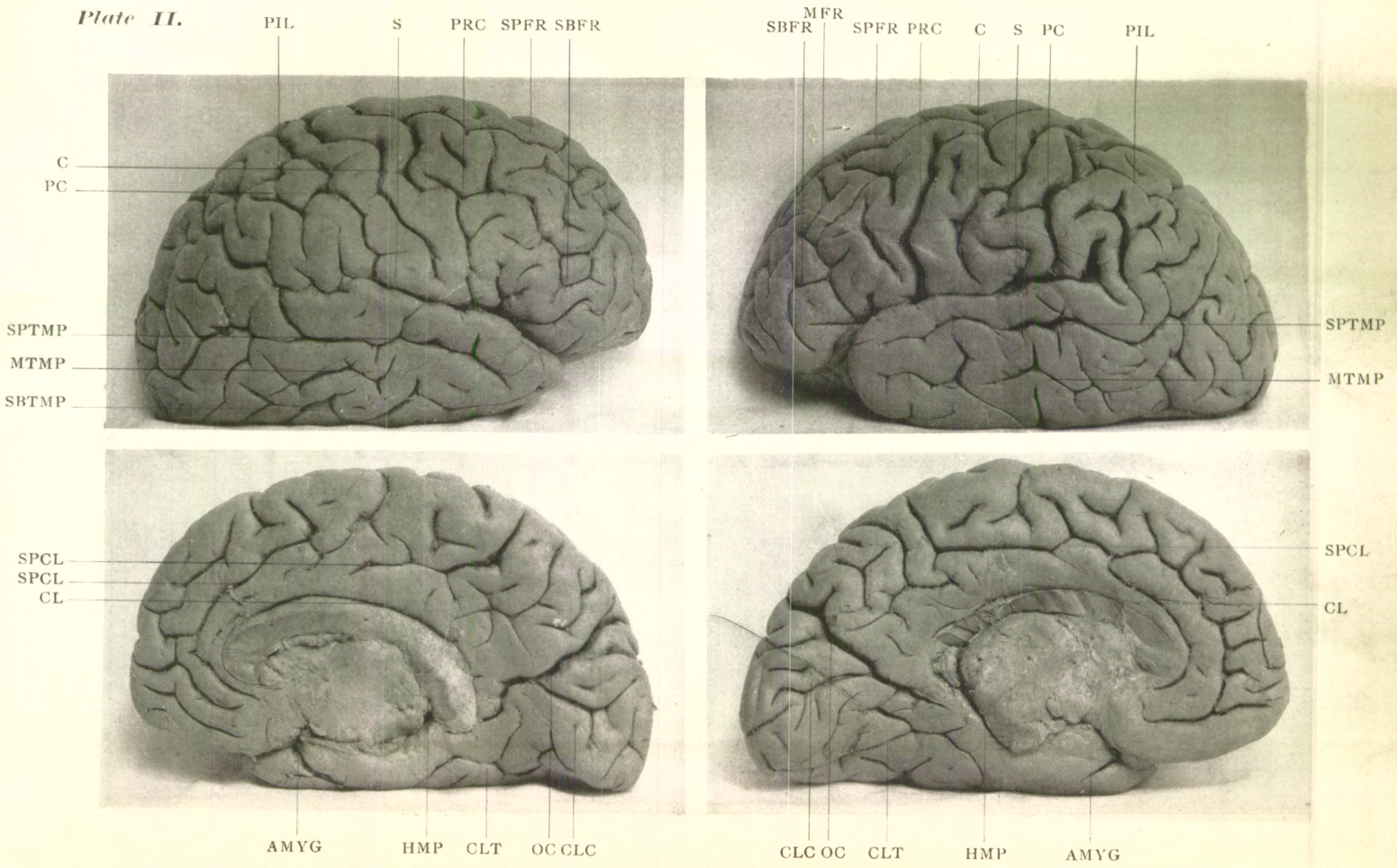
The brain was removed from a middle-aged Chinaman of the coolie class.

The first peculiarity observed is the more than usual outward and upward sloping of the orbital surface of both hemispheres, which is probably in correlation with the upward and outward inclination of the palpebral orifice in the Chinese.

Right hemisphere.—The Sylvian fissure shows no special peculiarity. It seems to make shallow connection with the vertical arm of the supertemporal, but this is a superficial appearance. The central fissure is nowhere confluent. The insula is not exposed. The precentral fissure is well defined, communicating below with the Sylvian, and above with the subfrontal. The medifrontal fissure is not distinctly out-

[1] This brain was first exhibited and described by Dr. A. J. Parker at the Philadelphia Neurological Society.

Plate II.



CHINESE BRAIN.

lined, and there are not, therefore, four distinctly demarcated frontal gyres. The superfrontal fissure is well defined in the posterior two thirds of its usual length. The subfrontal is clearly marked, and communicates, as stated, with the precentral. The primary fissures of the frontal lobe present a curious regularity of undulation. This brain generally has a peculiarity of this kind difficult to describe. The orbital fissuration is peculiar. About the middle of the orbital surface is a large H-shaped fissure,[1] the cross bar of the H being sagittal, and its lateral arms much curved. In front of this fissure is a small fissure which repeats the cross bar in one of the arms of the H. Posterior to the H-shaped fissuration are three shallow sagittal markings. The parietal fissure is somewhat perplexing. The so-called retrocentral fissure (post central of Wilder), which is usually regarded as a vertical elongation of the anterior extremity of the parietal, forms a fissure extending across the lobe from the Sylvian to the sagittal fissures, which is parallel with and of about the same length as the central fissure, as clearly demarcating the postcentral gyre behind as it is demarcated in front by the central fissure. Taking the lower half of this postcentral fissure as the beginning of the parietal, the latter extends a short distance backwards and is then interrupted by a well-developed gyre. It then has a posterior branch which is joined in front by the supertemporal and runs behind into the transverse occipital.[2] This posterior extension of the fissure is not well shown in the figure. The parietal gyre is of moderate size; the marginal gyre is small The occipital fissure is well outlined, and is in communication with the calcarine, but not with the hippocampal. The cuneus is of peculiar shape, and is crossed by a fissure which runs across the median edge of the hemisphere. The first occipital gyre of Ecker (paroccipital of Wilder) is developed to the common brain level. None of the so-called *plis de passage* can be made out as such. One of the remarkable

[1] Wilder has proposed the general name *zygal* (yoked) for all H-shaped fissures like the orbital and his paroccipital.

[2] The terms "transverse occipital," and "parietal" (interparietal") have been used as employed by Ecker, as the views of Prof. Wilder with reference to these "fissures" are still under discussion.

peculiarities of the brain is the great extent of the supertemporal fissure of this hemisphere, which, beginning near the anterior extremity of the temporal lobe, passes backwards and upwards across the entire extent of the parietal lobe and over the median edge of the hemisphere for the distance of half an inch, terminating in the precuneus just in front of the occipital fissure, and merging in its course, as already stated, with the posterior branch of the parietal fissure. This at least seems to be the proper interpretation to put upon the fissuration, although a backward extension of the horizontal portion of the fissure might be regarded by some as its true continuation. The subtemporal and collateral fissures are well defined. The supertemporal gyre is of good size. Wernicke's fissure, *exoccipital* of Wilder, *anterior occipital* of Schwalbe, is well shown, communicating in front with the supertemporal. A well-marked fissure passes across the occipital lobe just below its shelving extremity. The amygdaline fissure of Wilder is present. The supercallosal fissure is not continuous; it is divided into two distinct parts, both having the same shape, but the anterior is a little longer than the posterior. The anterior bends upward in front of the line of the precentral fissure; the posterior, just behind the central. Some might regard this fissure as divided into three or even four parts. The conditions as to fissuration present on the whole upper portion of the median face of this hemisphere illustrate Parker's "vegetative repetition" of fissures. The inflected fissure of Wilder here appears to be simply one of these vegetative repetitions. The precuneus is crossed by a fissure deep and well defined, which passes far over into the lateral aspect of the hemisphere.

Left hemisphere.—The Sylvian fissure is longer in its horizontal arm than the same fissure of the right hemisphere. Its ascending branch, as on the other side, is illy defined. The central fissure, clearly marked, is non-confluent. There is a depression about the junction of the middle and upper thirds of the postcentral gyre; the gyre is poorly developed in this position, as also at a point near the junction of the middle and lower thirds. The precentral fissure has a

deep communication with the Sylvian. The superfrontal fissure is deep and well defined, but neither a medifrontal nor a subfrontal are well outlined, the markings being as positive in a transverse as in an antero-posterior direction. The frontal lobe is comparatively little elaborated. The orbital surface presents one H-shaped and several small, irregular fissures. The parietal fissure, passes uninterrupted across the parietal lobe to the so-called transverse occipital, beginning close to the Sylvian fissure, just in front of its posterior bifurcation. The parietal and marginal gyres are of fair size and development. The occipital and calcarine fissures and cuneus are similar to the homologous parts on the other side. A fissure begins in the fork formed by the posterior extremity of the calcarine fissure and reaches around the tip of the occipital lobe. The supertemporal fissure is very well developed, but has not the great extent of the same fissure in the other hemisphere, its posterior vertical arm stopping a little short of the parietal fissure. The subtemporal and Wernicke's fissure can be well made out. The collateral fissure is well marked, but turns upward across the temporal lobe about its middle. The supercallosal fissure is long, continuous, and typical in appearance, very different from the other side, but the surface of the hemisphere above it presents a series of short, nearly vertical, vegetative repetitions. The amygdaline and inflected fissures of Wilder are present.